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Results of Vascular Reconstructions for Atherosclerotic Arterial Occlusive Disease of the Lower Limbs in Young Adults

Harry van Goor and Ab. H. Boontje

Department of Surgery, University Hospital Groningen, The Netherlands

Objective: *To evaluate early and long-term results of vascular reconstructions for arterial atherosclerotic occlusive disease (AOD) of the lower limb in young patients under the age of 40 years.*
Design: *Retrospective study.*
Setting: *University hospital.*
Materials: *Twenty-nine young adults, who underwent vascular reconstruction for histologically proven AOD of the aortoiliac and/or femoropopliteal segments in a 15-year period.*
Chief outcome measures: *Early and late mortality, failure of vascular reconstructions, additional procedures, other manifestations of atherosclerosis, recurrence of symptoms.*
Main results: *Nine patients (31%) died, seven related to atherosclerotic disease. In 21 patients (72%) initial vascular reconstruction(s) failed. Twenty-two patients (76%) underwent surgery for failures and/or progression of AOD in other segments of the lower limb. Amputation was performed in five patients (17%). At the end of the follow-up period only 25% of surviving patients were asymptomatic.*
Conclusion: *Young patients undergoing vascular reconstructions for AOD of the lower limbs, in particular those who initially have extensive and progressive atherosclerosis, have a poor outcome in terms of a high mortality and a high operative failure rate. A liberal attitude towards reconstructive surgery, particularly in claudication, is not warranted.*

Key Words: Young adults; Atherosclerosis; Lower limbs; Vascular reconstruction; Progression; Amputation.

Introduction

Arterial occlusive disease (AOD) in young adults is relatively uncommon, but as in the older age group, atherosclerosis is the most common cause. Atherosclerotic disease in younger patients is considered more progressive, causing poor results following vascular reconstructions and shortened life expectancy.[1,2] However, long-term improvement and limited mortality are also reported suggesting a more liberal policy towards arterial surgery.[3] The surgical approach in young claudicants seems to be more aggressive than in older patients, as this disability is not accepted in terms of working and sports activities.

This study describes the early and long-term results after arterial reconstruction for AOD of the lower limbs in young adults under the age of 40.

Please address all correspondence to: Ab. H. Boontje, Department of Surgery, University Hospital Groningen, Oostersingel 59, 9713 EZ Groningen, The Netherlands.

Patients and Methods

From 1972 to 1986, a total number of 1432 patients with AOD of the aortoiliac and/or femoropopliteal segments, underwent a primary vascular reconstruction at our surgical department. Twenty-nine of these patients (2%) were included in this study based on the following criteria: (1) age less than 40 years. (2) no systemic disease such as vasculitis, Buerger's disease, history of trauma, embolism or diabetes mellitus. (3) confirmation of the diagnosis of atherosclerosis by histological examination of resected specimens after endarterectomy or by means of a biopsy after bypass procedures. There were 18 men and 11 women (mean age, 35 years, range 22–39). Twenty-seven of the patients (93%) were cigarette smokers, eight (28%) were treated for hypertension, six (21%) had hyperlipidaemia. Six patients (21%) had one or more family members, who had died early due to myocardial infarction. Nine of 11 female patients (82%) used oral contraceptives. The mean number of risk factors in

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Table 1. Initial vascular reconstructions and failures during follow-up in 29 patients

Type of reconstruction	(n)	Failures					
		< 3 months (n)	3–12 months (n)	1–3 years (n)	3–5 years (n)	5–10 years (n)	Total (n)
AIF endarterectomy	13		1	3	2	3	9
AIF bypass							
Bilateral	3	1		1			2
Unilateral	6		1		1	1	3
FP bypass							
Above knee	6	1		1		2	4
Below knee	5	1	4				5
Fem-Fem bypass	1	1					1
Total	34	4	6	5	3	6	24

AIF, aortoiliac-femoral; FP, femoropopliteal; Fem-Fem, femoro-femoral.

men (1.6) did not differ significantly from that in women (2.0).

The indications for surgery were disabling claudication in 22 cases (76%) and limb-threatening ischaemia (rest pain or gangrene) in seven (24%). The mean duration of claudication was 33 months (range 3–96 months). The mean pain-free walking distance, measured under standardised conditions, of claudicants was 150 m, with a range of 50–500 m. At preoperative arteriography, occlusive disease was localised in the aortoiliac segment in 12 patients (8 male, 4 female), in the femoropopliteal segment in eight patients (6 male, 2 female), and in both segments in nine patients (4 male, 5 female). The initial surgical procedures are shown in Table 1. A total of 34 vascular reconstructions and four additional lumbar sympathectomies, in cases of limb threatening ischaemia, were performed. From the medical records, mortality and morbidity, including arterial reconstructive failures, operations for failures and further surgery (Table 2), other manifestations of atherosclerosis (Table 3), and recurrence of clinical symptoms were assessed. No patients were lost to follow-up.

Statistical analysis was performed using the Chi-square test and the Yates and Cochran rank test, when appropriate. A p-value less than 0.05 was considered significant.

Results

Nine of the 29 patients (31%), four men and five women, died on average 10 years (range 0.5–21 years) after initial surgery. The causes of death were myocardial infarction (6), ruptured aneurysm of the thoracic aorta (1) and sepsis (2) i.e. 77% of the deaths were related to atherosclerosis. Both the patients who died from sepsis had the infectious focus in an amputation stump.

Table 2. Operations for failures and additional surgical procedures for atherosclerotic disease in other segments of the lower limb in 22 patients

Type of operation	n
Aortoiliac-femoral bypass	8
Axillobifemoral bypass	1
Iliac-femoral endarterectomy	7
Femorofemoral bypass	3
Femoropopliteal bypass	7
Aortotibial bypass	1
Single trombectomy	6
Correction anastomotic aneurysm	7
Lumbar sympathectomy	6
Major amputation	8
Total	54

Four early failures (< 3 months after reconstruction) occurred in four patients (Table 1). Twenty late failures (> 3 months after reconstruction) occurred in 17 patients. Within 1 year all five below knee femoropopliteal bypasses (2 autologous reversed saphenous vein grafts and 3 human umbilical vein grafts) had occluded. Eventually, 24 of the 34 initial vascular reconstructions (71%) failed in 21 of 29 patients (72%). A total of 54 operations for failures or for atherosclerotic disease in other segments of the lower limb were performed in 22 patients (mean 2.5, range 1–7 operations) during follow-up. These are summarised in Table 2. Five of the 29 patients (17%) underwent eight major amputations: 0.5–10 years after initial reconstruction. In five patients no reintervention for failure was performed.

Fifteen of the 29 patients (52%) developed signs and symptoms of atherosclerotic disease, other than in the lower limbs, during the follow-up period (Table 3). Coronary artery disease and hypertension were most frequent. The results in survivors and non-survivors are summarised in Table 4. Non-survivors had more generalised atherosclerotic disease as reflected by a more frequent involvement of both aortoiliac and

Table 3. Other atherosclerotic manifestations (23) in 15 of 29 patients (52%)

Disease	n
Coronary artery disease	10
Hypertension	7
Cerebrovascular accident	1
Symptomatic carotid artery stenosis	1
Renal artery stenosis	3
Subclavian artery occlusion	1
Total	23

Table 4. Indication for surgery, localisation, progression and other manifestations of AOD, failures and additional surgery of the lower limb in 20 survivors and nine non-survivors

	Survivors	Non-survivors	*p*-value
Claudication	17/20	5/9	NS
Restpain	3/20	4/9	NS
No. of risk factors	34/20	17/9	NS
AOD in both segments	2/20	7/9*	<0.01
Symptomatic AOD in other segments	9/20	9/9	<0.05
Failure initial procedure(s)	13/20	8/9	NS
Additional surgery lower limb	10/20	9/9	<0.02
No. of other manifestations of AOD	11/20	12/9	<0.01

* All women, who died, had AOD in both segments.

femoropopliteal segments, development of AOD in other segments than the initial ones during follow-up, additional surgery during follow-up, and other manifestations of atherosclerosis, compared with survivors. Limb salvage was successful in five out of seven patients with limb-threatening ischaemia. In 14 of the 22 patients initially operated on for claudication, the claudication persisted, three had undergone an amputation, one had rest pain, and only four were asymptomatic at the end of follow-up.

At follow-up (mean 12.3, range 6.5–22 years), only five of 20 surviving patients (25%) were asymptomatic, 12 (60%) had claudication, one (5%) rest pain, and two (10%) were amputated.

Discussion

Lower limb ischaemia and arterial surgery for symptomatic AOD in young patients is rare. About 2% of patients, who underwent a primary vascular reconstruction for lower limb ischaemia in our department, were under the age of 40. However, the incidence might have been higher since only patients without diabetes and in whom a biopsy of the occluded artery was taken and atherosclerosis was proven histologically, were included in this study. The percentage of females in this group was high, in comparison with older age groups, and atherosclerotic disease was more often localised in the aortoiliac segment. This predominance of aortoiliac lesions in young patients, especially females, has been associated with the presence of multiple risk factors including the use of contraceptives.[4–6] Although 82% of our female patients used contraceptives, we did not find a markedly higher number of risk factors in females compared with males. The actual number of risk factors is probably higher, since no routine screening on coagulation status and enzyme disorders like homocystinuria was carried out in these patients.

Atherosclerosis in young patients has been described as "virulent" with severe symptoms, an aggressive course, early disability and early death.[3,5,7] The percentage of patients with symptoms of limb-threatening ischaemia, however, was relatively low. The exclusion of diabetic patients from these series may be responsible, since they, in particular, suffer from ischaemia due to distal atherosclerotic disease. The aggressive course of the AOD seems to be reflected by the high failure rate of vascular reconstructions (71%) and the unusual high amputation rate (17%) for non-diabetic patients.[7] The results of operative treatment were similar to those reported previously.[3,7,8] Like Levy *et al.* we found many failures within the first postoperative year, so progression of distal disease as an explanation for the high failure rate seems unlikely.[7] Only three patients (one non-survivor, two survivors) stopped smoking after the first operation. Continuation of smoking may be an important factor for failure, as its injurious effects are supposed to be greater at an early age.[5]

As compared with an age- and sex-matched background population (1% mortality rate during 5 years, 2.5% mortality during 10 years), a mortality rate of 31% in our patient group, on average 10 years after initial surgery, is high. Non-survivors had more generalised symptomatic atherosclerotic disease and more frequently underwent additional surgery of the lower limb than survivors, despite similarity in failure rate and number of risk factors. Moreover, cardiovascular atherosclerotic disease developed more frequently in non-survivors. From this it emerges that there is a group of young patients with an even more aggressive course of their disease, eventually leading to early death, which does not seem to be predicted by traditional risk factors. This necessitates the identification of other risk factors playing a role in premature atherosclerosis.

As with other series, patients with disabling claudication predominate in the present one.[3,7] In view of the high incidence of failures, the low rate of asymptomatic patients at follow-up, and their limited life expectancy, the benefits of reconstructive surgery should be questioned. This is emphasised by the fact that most patients eventually accepted the same walking distance as they had before their initial surgery. Based on the present data a more aggressive approach in younger, compared with elderly, patients is probably not warranted.

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